SOUTH CAROLINA Energy Office

Energy Briefs

Helping the Homeowner Live Energy Efficiently

Solar Water Heating

This publication provides basic information on the components and types of solar water heaters currently available and the economic and environmental benefits of owning a system. Although the publication does not provide information on building and installing your own system, it should help you discuss solar water heating systems intelligently with a solar equipment dealer.

Solar water heaters, sometimes called solar domestic hot water systems, may be a good investment for you and your family. A solar water heating system in South Carolina can supply up to 75 percent of your annual hot water needs. Solar water heaters are cost competitive in many applications when you account for the total energy costs over the life of the system. Although the initial cost of solar water heaters is higher than that of conventional water heaters, the fuel (sunshine) is free. The simple return on your investment is between four and seven years. Plus, they are environmentally friendly. To take advantage of these heaters, you must have an unshaded, south-facing location (a roof, for example) on your property.

Solar water heating systems use the sun to heat either water or a heat-transfer fluid, such as a propylene glycol antifreeze mixture, in collectors generally mounted on a roof. The heated water is then stored in a tank similar to a conventional gas or electric water tank. Some systems use an electric pump to circulate the fluid through the collectors.

Solar water heaters can operate in any climate. Performance varies depending in part on how much solar energy is available at the site, but also on how cold the water coming into the system is. The colder the water, the more efficiently the system operates. In almost all climates, you will need a conventional backup system. In fact, many building codes require you to have a conventional water heater as the backup.

First Things First

Before investing in any solar energy system, it is more cost effective to invest in making your home more energy efficient. South Carolinians spend up to 25 percent of their annual electric bills, and up to 20 percent of their natural gas bills, on heating water. Taking steps to use less hot water and to lower the temperature of the hot water you use reduces the size and cost of your solar water heater.

Good first steps are installing low-flow showerheads or flow restrictors in shower heads and faucets, insulating your current water heater, and insulating any hot water pipes that pass through unheated areas. If you have no dishwasher, or if your dishwasher is equipped with its own automatic water heater, lower the thermostat on your water heater to 120 degrees F.

You will also want to make sure your site has enough available sunshine, at least four to six hours per day, to meet your needs efficiently and economically. The system should also face south or within 45 degrees of south. Your local solar equipment dealer can perform a solar site analysis for you or show you how to do your own.

Remember, local zoning laws or covenants may restrict where you can place your collectors. Check with your city, county and homeowners association to find out about any restrictions.

Recirculation systems are a specific type of open-loop system that provide freeze protection. They use the system pump to circulate warm water from storage tanks through collectors and exposed piping when temperatures approach freezing. Consider recirculation systems only where mild freezes occur once or twice a year at most. Activating the freeze protection more frequently wastes electricity and stored heat.

Of course, when the power is out, the pump will not work and the system will freeze. To guard against this, a freeze valve can be installed to provide additional protection in the event the pump doesn't operate. In freezing weather, the valve dribbles warmer water through the collector to prevent freezing.

Closed-Loop Active Systems

These systems pump heat-transfer fluids (usually a glycol-water antifreeze mixture) through collectors. Heat exchangers transfer the heat from the fluid to the household water stored in the tanks.

Double-walled heat exchangers prevent contamination of household water. Some codes require double walls when the heat-transfer fluid is anything other than household water.

Closed-loop glycol systems are popular in areas subject to extended freezing temperatures because they offer good freeze protection. However, glycol antifreeze systems are a bit more expensive to buy and install, and the glycol must be checked each year and changed every three to ten years, depending on glycol quality and system temperatures.

Drainback systems use water as the heat-transfer fluid in the collector loop. A pump circulates the water through the collectors. The water drains by gravity to the storage tank and heat exchanger; there are no valves to fail. When the pumps are off, the collectors are empty, which assures freeze protection and also allows the system to turn off if the water in the storage tank becomes too hot.

Pumps in Active Systems

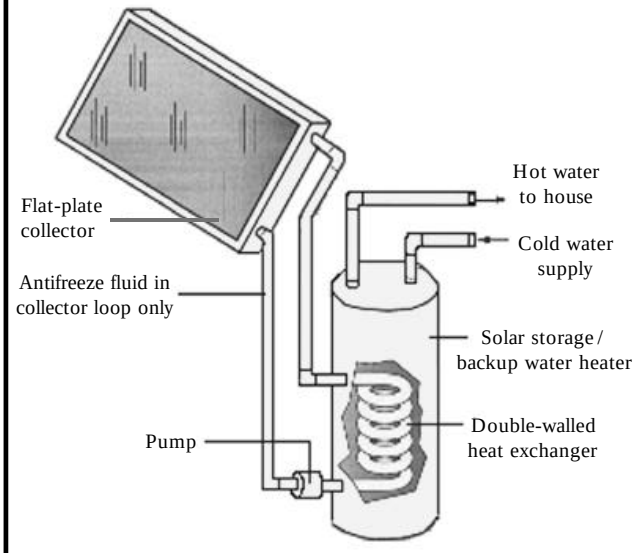
The pumps in solar water heaters have low power requirements, and some companies now include direct current (DC) pumps powered by small solar-electric (photovoltaic, or PV) panels. PV panels convert sunlight into DC electricity. Such systems cost nothing to operate and continue to function during power outages.

Passive Systems

Passive systems move household water or a heat-transfer fluid through the system without pumps. Passive systems have no electric components to break. This makes them generally more reliable, easier to maintain, and possibly longer lasting than active systems.

Passive systems can be less expensive than active systems, but they can also be less efficient. Installed costs for passive systems range from about $1,000 to $3,000, depending on whether it is a simple batch heater or a sophisticated thermosiphon system.

Active, Closed-Loop Solar Water Heater



An active, closed-loop system heats a transfer fluid (such as water or antifreeze) in the collector and uses a heat exchanger to transfer the heat to the household water.

Sizing Your System

Just as you have to choose a 30-, 40-, or 50-gallon conventional water heater, you need to determine the right size solar water heater to install. Sizing a solar water heater involves determining the total collector area and the storage volume required to provide 100 percent of your household's hot water during the summer. Solar-equipment experts use worksheets or special computer programs to assist you in determining how large a system you need.

Solar storage tanks are usually 50-, 60-, 80-, or 120-gallon capacity. A small (50- to 60-gallon) system is sufficient for one to three people; a medium (80-gallon) system is adequate for a three- or four-person household, and a large (120-gallon) system is appropriate for four to six people.

A rule of thumb for sizing collectors: allow about 20 square feet of collector area for each of the first two family members and 8 square feet for each additional family member if you live in the Sun Belt, which includes South Carolina. Allow 12 to 14 additional square feet per person if you live in the northern United States.

A ratio of at least 1.5 gallons of storage capacity to 1 square foot of collector area prevents the system from overheating when the demand for hot water is low. In very warm, sunny climates such as South Carolina, experts suggest that the ratio should be at least 2 gallons of storage to 1 square foot of collector area. For example, a family of four in a southern climate would need between 64 and 68 square feet of collector area and a 128- to 136-gallon storage tank. (This assumes 20 square feet of collector area for the first person, 20 for the second person, 12 to 14 for the third person, and 12 to 14 for the fourth person. This equals 64 to 68 square feet, multiplied by 2 gallons of storage capacity, which equals 128 to 136 gallons of storage.)

Benefits of Solar Water Heaters

There are many benefits to owning a solar water heater, and number one is economics. Solar water heater economics compare quite favorably with those of electric water heaters, while the economics are not quite so attractive when compared with those of gas water heaters. Heating water with the sun also means long-term benefits, such as being cushioned from future fuel shortages and price increases, and environmental benefits.

Economic Benefits

Many home builders choose electric water heaters because they are easy to install and relatively inexpensive to purchase. However, research shows that an average household with an electric water heater spends about 25 percent of its home energy costs on heating water.

It makes economic sense to think beyond the initial purchase price and consider lifetime energy costs, or how much you will spend on energy to use the appliance over its lifetime. The Florida Solar Energy Center (FSEC - see Source List) studied the potential savings to Florida homeowners of common water-heating systems compared with electric water heaters. It found that solar water heaters offered the largest potential savings, with solar water-heater owners saving as much as 50 to 85 percent annually on their utility bills over the cost of electric water heating.

The FSEC analysis illustrates that the initial installed cost of the solar water heater ($1,500 to $3,000) is higher than that of a gas water heater ($350 to $450) or an electric water heater ($150 to $350). The costs vary from region to region, so check locally for costs in your area. A list of regional solar and photovoltaic dealers is included with this brief. No matter the price of fuel sources, the solar water heater is always more economical over the lifetime of the system than heating water with electricity, fuel oil, propane or even natural gas because the fuel (sunshine) is free.

Tax Incentives and Rebates

Some electric utilities offer rebates to customers who install solar energy equipment because these installations help utilities reduce peak loads. Peak loads are periods when the utility must generate extra power to meet a high demand. Heating water in the evening is one example.

You can determine the simple payback of a solar water heater by first determining the net cost of the system. Net costs include the total installed cost less any tax incentives or utility rebates. After you calculate the net cost of the system, calculate the annual fuel savings and divide the net investment by this number to determine the simple payback.

Source List

The following sources can provide you with information to help you find the solar water heater that is right for you.

South Carolina Energy Office
1201 Main Street, Suite 1010
Columbia, SC 29201
(803)737-8030
(800) 851-8899
Fax (803) 737-9846
http://www.energy.sc.gov

The Energy Efficiency and Renewable Energy Clearinghouse (EREC)
P.O. Box 3048
Merrifield, VA 22116
(800) 363-3732
Fax: (703) 893-0400
E-mail: doe.erec@nciinc.com
www.eren.doe.gov/consumerinfo/factsheet.html

Florida Solar Energy Center (FSEC)
1679 Clearlake Road
Cocoa, FL 32922-5703
(407) 638-1000
Fax: (407) 638-1010
http://www.fsec.ucf.edu
E-mail: info@fsec.ucf.edu

National Renewable Energy Laboratory
1617 Cole Blvd.
Golden, CO 80401-3393
(303) 275-3000
Fax: (303) 275-4035
http://www.nrel.gov

North Carolina Solar Center
Box 7401, North Carolina State University
Raleigh, NC 27695-7401
(919) 515-3480
Fax: (919) 515-5778
http://www.ncsc.edu

Solar Energy Industries Association (SEIA)
1111 North 19th Street, Suite 260
Arlington, VA 22209
(703) 248-0702
Fax: (703) 248-0714
http://www.seia.org
E-mail: info@seia.org

Solar Rating & Certification Corporation (SRCC)
c/o FSEC
1679 Clearlake Road
Cocoa, FL 32922-5703
(407) 638-1537
Fax: (407) 638-1010
http://www.solar-rating.org
E-mail: srcc@fsec.ucf.edu

List of Solar Dealers

EasySolar Systems
P.O. Box 12024
Greenville, SC 29612-0024
www.easysolar.com
*Photovoltaics
*Pool Heating
(864) 292-0873

SolarSource
13620 49th Street North
Clearwater, FL 33762
www.heliocol.com
*Water Heating
*Pool/spa heating
1-800-797-6527

SunQest
1555 Rankin Ave.
Newton, NC 28658
*Water heating
*Pool/spa heating
*Radiant floor heating
(828) 465-6805

American Energy Technologies, Inc.
1057 North Ellis Rd., Unit 4
Jacksonville, FL 32254
www.aetsolar.com
*Water Heating
*Pool/spa heating
1-800-874-2190

Photovoltaics:

Energy Conservation Services of North Florida, Inc.
6120 SW 13th Street
Gainesville, FL 32608
www.ecs-solar.com
*Photovoltaic systems
(352) 377-8866

United Solar Systems Corporation
1100 West Maple Rd.
Troy, MI 48084
www.unisolar.com
*Amorphous PV systems
1-800-843-3892

New England Solar Electric, Inc.
P.O. Box 435
3 South Worthington Rd.
Worthington, MA 07098
*Photovoltaic systems
(413) 238-5974

Sunnyside Solar
1014 Green River Rd.
Guilford, VT 05301
http://www.sunnysidesolar.com
*Photovoltaic systems
(802) 257-1482

Sunelco
P.O. Box 787
Hamilton, MT 59840-0787
www.sunelco.com
*Photovoltaic systems
1-800-338-6844